edge of ostium thick. Zooids 4·0 to 5·0 mm., blackish, fading to pale brown; arms usually 8 pairs ..... *solidus.*

7. Colony bulky and massive, or small and lax if young (*rarus*), tubes long, common cœnœcial substance soft and spongy; ostium without a definite lip, transverse or oblique, edge of ostium thin. Zooids 4·0 to 7·0 mm., brownish or greyish; arms usually 8 pairs .... *densus* (including *rarus* and (?) *anderssoni*).

8. Colony diminutive, orange when fresh, pale in alcohol; ostia without definite lip. Zooids 2·2 mm., pale; arms 3 pairs ..... *indicus.*

II. Cavity of the cœnœcium continuous, and occupied in common by the zooids and their buds. Cœnœcium branching, with numerous spines. Arms of zooids commonly with end-swellings beset with refractive beads ..... *Demiothecia.*

a. Colony up to 200 or 250 mm. in height, cœnœcium amber-coloured or pale.

9, 10, 11. Colony much branched. Zooids 2·0 to 3·2 mm., crimson, brown, violet, or pale; arms 5 or 6 pairs. Species not easily distinguished, but *hodgsoni* is somewhat more robust, and with larger zooids, than *dodecalophus* ..... *dodecalophus, hodgsoni, (inæquatus = hodgsoni), æquatus.*

b. Colony diminutive and delicate, cœnœcium orange-coloured.

12. Zooids 1·3 mm., orange-coloured, with a few tracts of black pigment; arms 5 pairs, with end-swellings in buds. No males known ..... *gracilis.*

13. Zooids blackish; neuter zooids 1·3 mm., arms 4 pairs, no end-swellings; male zooids with one pair of arms only, without tentacles, numerous refractive beads. No females known ..... *sibogæ.*

LV.—*Observations on the Genus* Crassicauda.

By H. A. Baylis, M.A.

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Two sets of specimens from Deception Island, South Shetlands, kindly sent to the Museum recently by Mr. A. G. Bennett, throw interesting further light on this little-known genus of Nematodes. The host, in both these cases, was the

blue whale (*Balænoptera musculus*), and the worms were found with their caudal ends hanging freely into the urinary passage. In one case portions of the host's tissues (penis) were forwarded, and show the head-ends of the worms still deeply embedded. The tissue being very firm and muscular, and having been hardened in formalin, it has proved impossible, as is usually the case, to extract the worms intact. They pursue a very tortuous course in the tissues, and are easily broken in the attempt to remove them. The present account, therefore, will necessarily be confined to the characters of the posterior end.

In a former paper (1916) the writer described what was believed to be the head of an example of *Crassicauda crassicauda* (Crepl.). Up to that time there was no definite ground for believing that the genus included more than one species. In view, however, of certain considerations now to be set forth, there seems to be good reason for suspecting that two, and perhaps three, species of *Crassicauda* occur in whales.

The original worms described by Creplin (1829) as *Filaria crassicauda* were comparatively small, 6½ inches being given as the length of a complete male, 12 to 13 inches as that of a complete female. Creplin describes and figures a single spicule in the male. The greatest thickness (and this in one exceptionally thick female) was about 1 line [=about 2 mm.].

Leiper and Atkinson (1915), reporting on material contained in the 'Terra Nova' collection, which they had previously (1914) referred to *C. crassicauda* (making this the type of the new genus), remark that they were unable to find any spicules in the males, and conclude that they are absent. They also state that the material (which consisted only of headless fragments) included portions of both males and females of a length of 16 inches.

A re-examination of the 'Terra Nova' material, now in the British Museum, and its comparison with the new material from the South Shetlands, lead me to believe that the latter represents the true *C. crassicauda*, while Leiper and Atkinson's determination of the former as belonging to Creplin's species was erroneous. It is proposed, therefore, to regard the 'Terra Nova' specimens as representing a new and larger species, which may be named *Crassicauda boopis*. It attains a thickness of between 3 and 4 mm. Leiper and Atkinson unfortunately gave no figures of the worm. Figures of both forms are therefore given here for comparison.

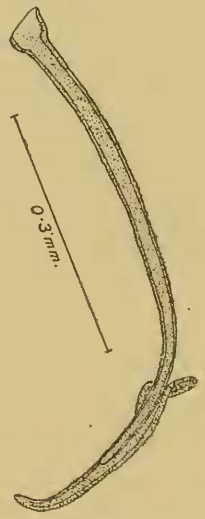
The material sent by Mr. Bennett includes fragments measuring up to about 16·5 cm. [=6½ inches] in length and not more than 2 mm. in thickness. The males have a

strongly coiled tail, and are provided with two spicules, which, though small, are easily seen in cleared specimens. These spicules (figs. 1 and 2 B) are unequal in length, measuring 0·62 mm. (left) and 0·3 mm. (right) respectively. They are completely covered externally with small rough granulations. Each spicule is considerably expanded at its proximal end and blunt distally.

The tails of both sexes show a very marked difference in size between the 'Terra Nova' and Mr. Bennett's specimens.

In the male (fig. 2) the distance from the cloacal aperture

Fig. 1.

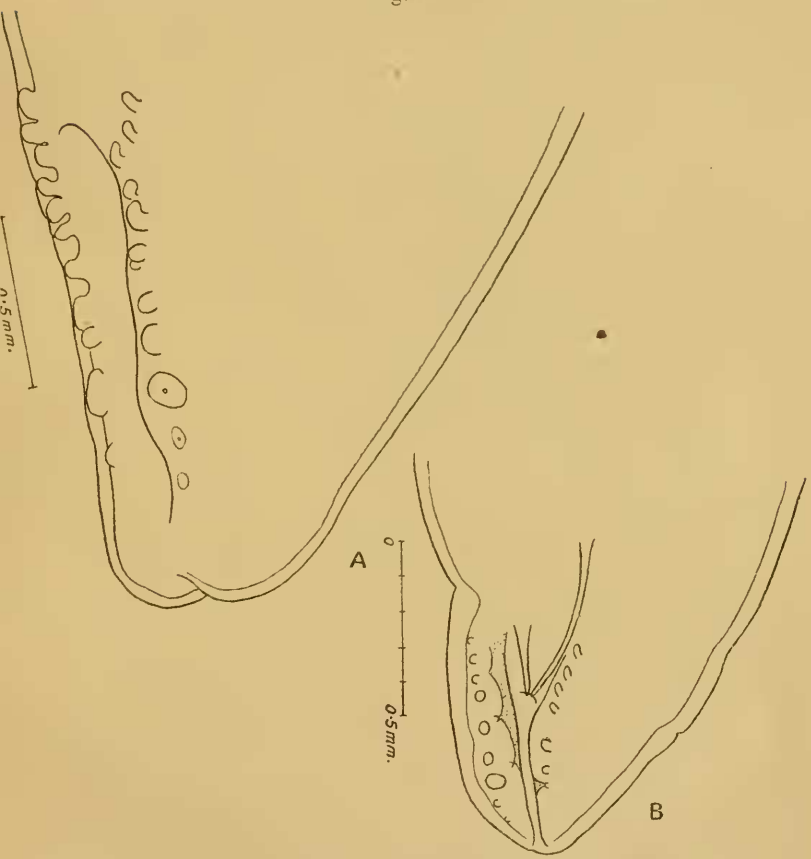


Crassicauda crassicauda. The two spicules of the male, seen from the left side.

to the tip of the tail is about three times as great in the former as in the latter. In the female (figs. 3 and 4), in all cases and in both species, the curious constriction in the region of the vulva, described and figured by Creplin, is well-marked. The vulva (figs. 3 A and 4, *v.*) lies towards the anterior end of the constriction, and the caudal end assumes the shape of a rounded or oval knob. The anus (figs. 3 A and 4, *a.*) lies in a depression at the posterior end of the latter. According to Creplin's figures, the terminal knob would measure 5 mm. in length in an exceptionally large specimen. Leiper and

Atkinson place the constriction at 3 mm. from the extremity, but this is clearly an understatement, as in some of the 'Terra Nova' females it is over 5 mm. from the tip of the tail. In the South Shetlands specimens the terminal knob measures only 1 mm. to 2·5 mm. in length.

Fig. 2.

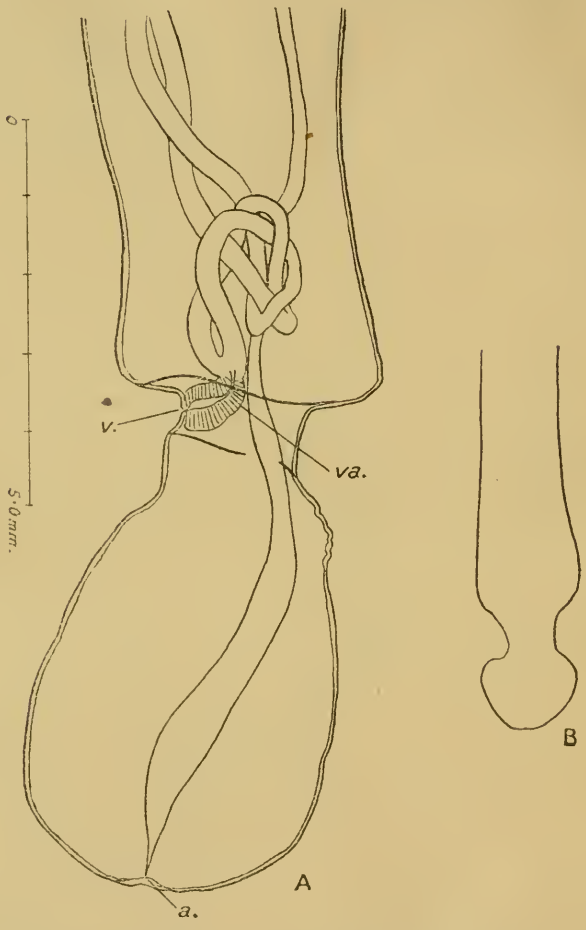


Nearly ventral views of the tail of the male, (A) of *C. boopis*, (B) of *C. crassicauda*, drawn to the same scale of magnification.

The writer has failed, as did Leiper and Atkinson, to discover any spicules in the 'Terra Nova' males. The remote possibility that they might have been left in the vagina of the females after copulation was thought of, but

examination of several females did not lead to the confirmation of this idea.

Fig. 3.

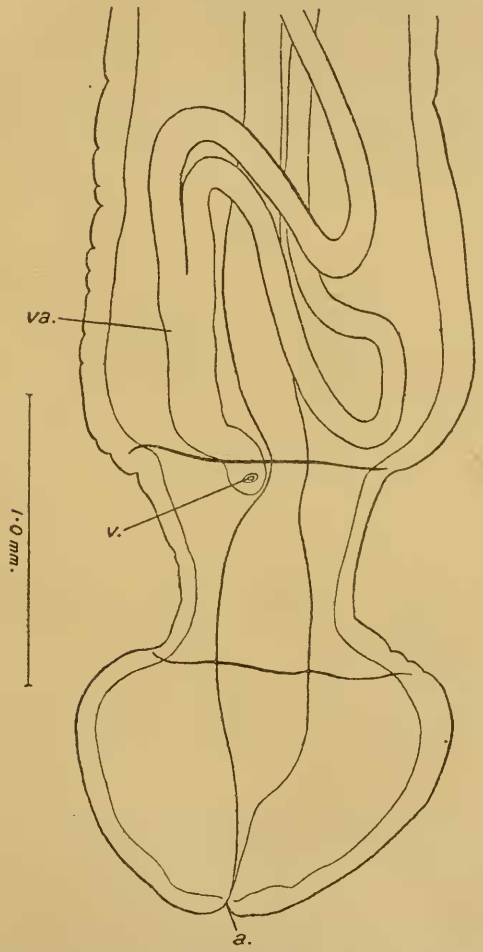


(A). *C. boopis*; tail of female, seen from the left side. *a.*, anus; *v.*, vulva; *va.*, vagina.
(B). *C. crassicauda*; outline of tail of female, drawn to the same scale of magnification as (A).

As regards the caudal papillæ of the male, Leiper and Atkinson state that there are on either side eight in the

'Terra Nova' material. On re-examination, however, the writer has not found less than nine on either side in any individual, while in one case (fig. 2 A) there were as many as

Fig. 4.



C. crassicauda; tail of female, nearly ventral view. *a.*, anus; *v.*, vulva; *va.*, vagina.

twelve on the left side and eleven on the right. It is not easy to count the papillæ accurately, owing to an infolding of the sides of the tail towards the mid-ventral line, so as to

form a groove extending from the cloaca to the tip of the tail. Some of the papillæ are not infrequently carried over so as to lie on the inside of this groove, and are thus only seen with some difficulty. In any case, however, the number on each side does not seem to be constant.

The same remarks apply, on the whole, to the material from the South Shetlands, the infolding of the sides of the tail (fig. 2 B) being often very marked. In this case the largest number of papillæ counted was eleven on the right side and eight on the left. The tail is laterally compressed in both forms, and slightly asymmetrical, the right side tending to be a little longer than the left. This is probably

Fig. 5.

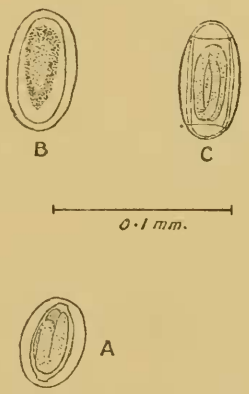
C. crassicauda; views of the caudal ends of two pairs of individuals, to show the position during copulation.

a peculiarity connected with the mode of copulation, which is well seen in the material sent by Mr. Bennett. Several pairs of individuals have remained, on fixation, in the position indicated in fig. 5. The manner in which the tail of the male is coiled round the constricted portion of the female is apparently constant. The tail makes two or three turns in the direction of a right-handed screw, but the last turn is reversed, so that the tip of the tail comes to lie in front of, instead of behind, the previous coil. This seems to offer an explanation of the slight asymmetry of the tail. Though Creplin noted the constriction in the region of the vulva, and speculated as to the probability of its being a natural

structure or artificially produced by the pressure of the male, he does not appear to have seen specimens in the position of copulation, nor did the 'Terra Nova' material throw any light on this point. From the constancy with which the constriction appears in females of all sizes, it seems probable that it is a preformed structure, and not merely due to the act of copulation itself.

The vagina (figs. 3 A and 4, *va.*), in both species, is very short and muscular, and gives off, almost immediately in front of the caudal constriction, two uteri, which are thick-walled and have a narrow lumen. These, after forming one or two coils, run, parallel to each other and nearly straight, in the

Fig. 6.



Ova, (A) of *C. boopis*, (B) and (C) of *Crassicauda* sp. (?) from *Hyperoodon*. (C) represents a later stage than (B), and shows the thickened belt of chitin.

direction of the head. The ova (fig. 6, A) have a very thick shell, and in both forms measure about $50\,\mu \times 35\,\mu$. They contain a coiled embryo when laid.

As regards the anterior end previously described by the writer (1916) as that of *C. crassicauda*, it is not at present possible to decide to which of the two species here distinguished it belongs. From its size alone it appears more probable that it is *C. boopis* than *C. crassicauda*. The various records of the occurrence of the supposed *C. crassicauda* were collected in the same paper, and a list of hosts was given. This, in view of the fact that the species of *Crassicauda* cannot now be regarded as one, will require some revision;

but it is impossible to settle definitely at present which records refer to which species, except as regards those dealt with in the present paper.

There seems to be reason for believing that yet a third species of *Crassicauda* may exist, differing from the two already considered in the size and structure of its eggs, and probably in other particulars. In 1916 Mr. Bennett sent to the Museum some fragments, in poor condition, of what appeared to be a species of this genus, from the kidney of a *Hyperoodon*, from the South Orkneys. The fragments contain immense numbers of ova (fig. 6, B, C) of a larger size (66 $\mu \times 33\ \mu$) than those of *C. crassicauda* and *C. boopis*, and of characteristic structure, in that the shell, in the fully-formed condition, has a thickened belt of chitin round the middle region, the ends being comparatively thin-shelled.

The following brief generic diagnosis may now be given (it being borne in mind that no complete account yet exists of any species) :—

CRASSICAUDA, Leiper and Atkinson, 1914.

Filariidæ (?) : Mouth without lips, but with one small papilla and three larger, more lateral papillæ on either side * ; cuticle thick, transversely striated, sometimes raised into a swelling which appears to act as a "holdfast." *Male* with laterally compressed and spirally coiled tail, with a ventral groove behind the cloaca ; at either side of the groove a somewhat irregular row of genital papillæ ; two small unequal spicules present, or spicules absent. *Female* with vulva near the posterior end of the body, in a constriction just in front of the knob-like caudal extremity ; vagina very short ; uteri two, parallel ; anus terminal ; ova with thick shell, containing a coiled embryo at the time of laying.

Hab. Various parts of the urinogenital system (or, exceptionally, other parts of the body) of Cetacea.

Genotype : *C. crassicauda* (Creplin, 1829) [nec *C. crassicauda* (Crepl.) of Leiper and Atkinson, 1914 & 1915].

Two species may at present be distinguished with some certainty, though their characters are as yet incompletely worked out, and the determination must depend upon measurements when male tails are absent :—

1. *Crassicauda crassicauda* (Crepl.).

Two unequal spicules present in the male. Thickness of

* See Baylis, 1916.

either sex not exceeding 2 mm. Distance of cloacal aperture of male from tip of tail about 0·5 mm. Distance of vulva from tip of tail about 1·5–3 mm.

Hosts: *Balænoptera physalus*, *B. musculus*, and (?) other whales.

2. *Crassicauda boopis*, sp. n.

[= *C. crassicauda* (Crepl.) of Leiper and Atkinson, 1914 & 1915.]

Spicules absent. Thickness of either sex may reach 3 mm. or more. Distance of cloacal aperture of male from tip of tail about 1·5 mm. Distance of vulva from tip of tail about 5–7 mm.

Only certain host: *Megaptera nodosa*.

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LVI.—*Freshwater Fishes from Madagascar.*

By C. Tate Regan, F.R.S.

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I. A Collection made by the Hon. P. A. Methuen.

A collection of fishes made in Madagascar in 1911 by the Hon. P. A. Methuen has been sent to me for determination by the Director of the Transvaal Museum, Pretoria. The list is as follows:—

Anguillidæ.

Anguilla mossambica, Peters.

Lake Alaotra and Ambatoharanana, E. Madagascar.